ENVIRONMENTAL WATER-QUALITY ZONES FOR STREAMS: A NEW REGIONALIZATION SCHEME

Dale M. Robertson and David A. Saad

U.S. Geological Survey, WRD, 8505 Research Way, Middleton, Wisconsin, USA, dzrobert@usgs.gov, dasaad@usgs.gov.

Biographical Sketch of Authors

Dale Robertson is research hydrologist with the U.S. Geological Survey and is a member of the USEPA Region 5 Regional Technical Assistance Group. David A. Saad is a hydrologist with the U.S. Geological Survey. Both authors are members of the Western Lake Michigan Drainages study unit of the National Water-Quality Assessment (NAWQA) program. The authors have developed regional stratification schemes for NAWQA and alternative regional stratification schemes for defining nutrient criteria in the Midwest. The authors have also developed techniques for determining nutrient and trace metal loads to the Great Lakes.

Abstract

Various approaches have been used to classify or subdivide large geographical areas into regions with relatively similar water quality. Water-quality data obtained from a few streams within each region are often assumed to represent the other unmonitored streams. A combination of the strengths of existing techniques was used to develop a new regionalization scheme. In this approach, a series of explanatory environmental factors for each monitored stream are first quantified using GIS. Regression-tree analyses are then used to determine which environmental characteristics are statistically most important in describing the distribution of specific water-quality constituents. Results from regression-tree analyses not only identify the most important environmental characteristics, but also provide a numerical value for each characteristic that aids in subdividing the area (for example, areas with less than or greater than 26 percent clay). Distributions (GIS coverages) of only the statistically most significant environmental characteristics are then used to subdivide the area of interest into relatively homogeneous environmental water-quality zones.

This approach results in a regionalization scheme customized for each water-quality constituent based on environmental characteristics statistically most related to the distribution of each constituent. Therefore, regionalization for constituents associated with runoff processes may be different than for those associated with ground-water flow. This approach was used to delineate zones of similar water quality (by including land-use characteristics) and zones of similar potential water quality (by excluding land-use characteristics) in an effort to help define nutrient criteria for streams in the Midwest.